

REMARKS/ARGUMENTS

Withdrawal of the 35 U.S.C. § 101 rejection is gratefully acknowledged.

In paragraph 4 of the Office action, claims 1-2, 5-11, 15-16, and 19-26 stand rejected under 35 U.S.C. § 102(b) as being unpatentable over Taylor (U.S. Patent No. 4,992,933) in view of Barker (U.S. Patent No. 4,922,933). In response, independent claims 1, 5, 8, 16, 20, 23, and 26 have been amended. Support for the amendments is found in the following paragraph from the published application:

[0074] By using the method of the present invention, PEs within a group of PEs can be individually controlled as to the output value which the PE selects for output into the final matrix. Thus, although all of the PEs are responding to the same command, e.g., an east to west wrap shift, each of the PEs is capable of selecting different data at different points during the execution of the instruction thereby enabling various types of data manipulations, e.g., transpose, reflection. Furthermore, by determining which PEs are active, additional flexibility is provided so that subsets of data can be manipulated. (emphasis added.)

Taylor discloses an array 12 of processing elements T(i,j) under the control of an array controller 14. See column 3, lines 32-35. The instruction format used in Taylor is illustrated in FIG. 3.

The "PeOp" field forms the operation code, or instruction, which is issued globally in parallel to processing elements in the array. The purpose of the row and column masks is to enable the instruction specified by the "PeOp" code to be executed by selected processing elements only. Taylor, column 5, lines 43-48.

Thus, Taylor does recognize that certain commands are issued globally. However, global commands can be changed:

In a SIMD array processor according to the present invention there are essentially two sorts of global instructions defined by the "PeOp" operation codes. These are global instructions which cannot be modified

locally and global instructions which can be modified locally. Taylor, Column 8, lines 11-16.

Also, Taylor provides a mechanism for enabling individual processors to be unresponsive to global PeOp codes.

The operation of the processing element is controlled by instructions, or operation codes, received from an array controller 14 over the instruction bus 18. The operation codes "PeOp" from the array controller are received in parallel on the instruction bus 18 from the array controller at the decoder 64 in each of the processing elements. As in prior art SIMD array processors, the status of the row and column select lines 20i and 22j for the processing element in question will determine whether the instruction is performed by that processing element or not. The decoder in each processing element is connected to the column and row select lines appropriate for the position of the processing element in the array. For the processing element P(i,j) on the ith row and the jth column this will be the ith row select line 20i and jth column select line 22j. When both the row and column select lines to a particular decoder 64 are selected, the decoder will decode the received operation code and thereby cause the processor to carry out the specified instruction by issuing control signals over control buses 66, 68 and 70 to the input multiplexer 62, the ALU 48 and the output multiplexer 56. Taylor, column 6, line 19 – column 7, line 2.

There is no disclosure in Taylor of selecting from among the data at any point during the execution of the command (claims 1, 16, 20, 23, 26) or at any point during shifting of data (claims 5, 8) because Taylor uses a very different control scheme. Taylor can mask out processing elements or enable processing elements to modify global commands, but Taylor does not provide a simple mechanism to enable each processing element to respond uniquely to a common command.

Applicant has implemented an elegant control scheme in which each processing element, responding to a common command, can select data for output at any time during the execution of the command or at any time during the shifting of data. In contrast, in Taylor, the data arrives at the correct location at the end of the execution of the command. As discussed in the example in Taylor in column 9, beginning at line 36:

[E]xactly M steps along the path leads to the correct processing element for the mapping. The North West quadrant of one possible way of setting out the set of loops for a 32 by 32 processor array is illustrated in FIG. 6. The remaining quadrants can be inferred by

rotational symmetry.

It will be noticed that some loops are shorter than others and some have a clockwise and some an anti-clockwise direction of shift as indicated by the arrows. However, the common factor for each of the loops is that a bit which is shifted 33 times along the loop on which it is located will end up in the corresponding position in the adjacent quadrant. In other words, in 33 steps, the whole array is rotated by 90 degrees. No individual count is necessary for each processing element and no selection among the received data at any time during the execution of the common command is required.

As is apparent from the foregoing quotation, there is no ability to select data at any point during the execution of the command or during the shifting of data.

The addition of Barker does not help the examiner's case against the currently amended claims. Even if Barker does provide a motivation to keep a count in individual processing elements, the control scheme of Taylor does not enable the selection of data at any point during the execution of a common command. The rejection under 35 U.S.C. § 103 based on Taylor in view of Barker should be withdrawn.

In paragraph 6 of the Office action, the examiner asserts that the Taylor/Barker combination teaches each of the recited elements of claim 5. Note that applicant has amended claim 5 to recite that data may be selected from among the received data "at any point during said data shifts." This is to be contrasted with the situation in Taylor/Barker where data is selected when the final shift has occurred. Accordingly, claim 5 is believed to be in condition for allowance.

In paragraph 9 of the Office action, the examiner asserts that the Taylor/Barker combination teaches all of the recited elements of claim 8. Note that claim 8 has been amended to recite that each processing element selects from among the received data, "at any point during said data shifting," one of the received data as a final output. This is in contrast to the Taylor/Barker combination which teaches that the final data is selected after the final shift has occurred. Claim 8 is believed to be in condition for allowance.

In paragraph 14 of the Office action, the examiner asserts that the Taylor/Barker combination teaches all of the elements of claim 16. Note that claim 16 has been amended to recite that selecting of output data for each active processing element may

occur “at any point during the execution of said command.” It is respectfully submitted that claim 16 is in condition for allowance.

In paragraph 16 of the Office action, the examiner asserts that the Taylor/Barker combination teaches all of the elements of independent claim 20. Note that independent claim 20 has been amended to recite that each processing element selects data from among the data received “at any point during the execution of said command.” This is in contrast to the Taylor/Barker combination which, according to the examiner, teaches that “when the final shift has occurred (as detected by the count), the array elements retain the data of the final shift, dependent on their location in the shift stream.” Claim 16 is believed to be in condition for allowance.

In paragraph 19 of the Office action, the examiner asserts that the Taylor/Barker combination teaches all of the elements of claim 23. Note that claim 23 has been amended to recite that the selection of data from among the data that a processing element has received occurs “at any point during the execution of said command.” This is in contrast to the Taylor/Barker combination which, according to the examiner, teaches that “data is stored in response to the desired output: when the final shift has occurred (as detected by the count) the array elements retain the data of the final shift, dependent on their location in the shift scheme.” It is respectfully submitted that independent claim 23 is in condition for allowance.

In paragraph 22 of the Office action, the examiner asserts that the Taylor/Barker combination teaches all of the elements of claim 26. Note that claim 26 has been amended to recite that the selecting may occur “at any point during the execution of said command.” This is in contrast to the Taylor/Barker combination which, according to the examiner, teaches that “when the final shift has occurred (as detected by the count) the array elements retain the data of the final shift.”

At this time, applicant has not addressed the rejection of the dependent claims inasmuch as it is applicant’s position that all of the independent claims are now in condition for allowance. Applicant reserves the right, at a later date, to argue the patentability of the dependent claims separately should that become necessary.

Cross Reference to Related Cases

Applicant wishes to remind the examiner that paragraph 1 of the instant application contains a list of related applications. That list of related applications was updated to include serial numbers in a preliminary amendment dated 07 October 2004. Applicant wishes to note that with respect to the four identified applications, U.S. Application Serial No. 10/689,300 has been allowed and has issued as U.S. Patent No. 7,209,180. U.S. Patent Application Serial No. 10/689,390 is currently on appeal. Prosecution of the other two applications is proceeding.

Request for Interview

Applicant has made a diligent effort to place the instant application in condition for allowance. If the examiner is of the opinion that the instant amendment does not place the currently pending claims in condition for allowance with respect to the art of record, the examiner is respectfully requested to contact applicant's attorney at the telephone number listed below **so that an interview may be scheduled before the issuance of an Office action rejecting the claims on the basis of the art currently of record.**

Respectfully submitted,



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